

MARINE
**(High-energy coastline, exposed to waves and currents,
with little or no dilution by fresh water)**

→ **MARINE SUBTIDAL**
(Permanently flooded by tidal waters; Page 108)
Flats

→ **MARINE INTERTIDAL**
(Alternately covered and exposed by tidal waters; Page 109)
Rocky Shore
Gravel/Sand Beach
Flats

ESTUARINE

(Ocean water diluted by freshwater, includes mouth of a river, bay, or sound, and areas up river)

ESTUARINE SUBTIDAL

(Permanently flooded by tidal waters; **Page 111**)

Saline/Brackish Flats
Fresh/Brackish Flats
Coastal Salt Pond

ESTUARINE INTERTIDAL

(Alternately covered and exposed by tidal waters; **Page 115**)

Saline/Brackish Flats
Fresh/Brackish Flats
Coastal Salt Pond Marsh
Salt Marsh
Brackish Tidal Marsh
Freshwater Tidal Marsh
Fresh/Brackish Tidal Shrubland
Fresh/Brackish Tidal Swamp

MARINE SUBTIDAL COMMUNITIES

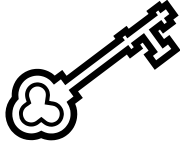
Description of Marine Subtidal Communities

Flats

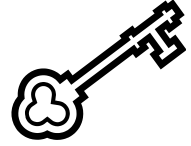
S4

Description/Concept	Sparsely to densely vegetated communities, dominated by invertebrates. Permanently submerged saline communities that occur in open ocean or near shore.
Topography	Permanently flooded by ocean water.
Soils/Substrate	Sandy to muddy soils in nearshore shallow water and offshore banks.
Canopy	
Sub-canopy	
Shrub layer	
Herb layer	May include eelgrass beds.
Leaf litter	N/A

NOTE: Because there is only one Marine Subtidal community type, there is no key provided.

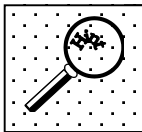


MARINE INTERTIDAL COMMUNITIES



Shortcut Key: Check full descriptions following use of key

1. Community characterized by a rocky substrate.
A. Yes – Rocky Shore
B. No – Go to 2
2. Community characterized by a substrate of sand and/or gravel.
A. Yes – Gravel/Sand Beach
B. No – Go to 3
3. Community characterized by a substrate of sediments, sand, silt, and clay.
A. Yes – Flats



These communities separate on the basis of substrate.

Descriptions of Marine Intertidal Communities

Rocky Shore

S2

Description/Concept	A rock substrate community dominated by invertebrates (crustaceans and mollusks) and non-vascular plants. Shows distinct zonation from splash zone to zone of complete inundation.
Topography	Extends from the supratidal splash zone to the limits of light penetration in the subtidal zone.
Soils/Substrate	Rock.
Canopy	
Sub-canopy	
Shrub layer	
Herb layer	Macroscopic algae (i.e., seaweed) is the dominant vegetation in community.
Leaf litter	N/A

Gravel/Sand Beach

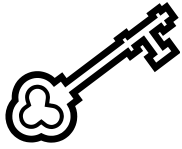
S4

Description/Concept	A highly stressed community in the intertidal (i.e., wave action) zone of beaches. Area exposed between high tides. Dominated by invertebrates and non-vascular plants.
Topography	Located below wrack line and above the permanent water.
Soils/Substrate	Gravel/sand.
Canopy	
Sub-canopy	
Shrub layer	
Herb layer	Sparse non-vascular plants.
Leaf litter	N/A

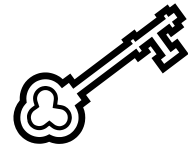
Flats

S4

Description/Concept	Marine intertidal areas protected from intense wave action. More protected than Marine Intertidal: Gravel/Sand communities. Physically and biologically linked to coastal marine systems.
Topography	Protected, low-energy coastal sites between low and high tidal limits. Sometimes bordered by salt marshes on the landward side and tidal channels or subtidal eelgrass beds on the seaward side.
Soils/Substrate	Relatively stable sediments with various proportions of silt, clay, sand, and organic materials.
Canopy	
Sub-canopy	
Shrub layer	
Herb layer	May include eelgrass beds. Some areas sparsely vegetated. Macro-algae (i.e., seaweed) is abundant.
Leaf litter	N/A




ESTUARINE SUBTIDAL COMMUNITIES



Shortcut Key: check full descriptions following use of key

1. Community located in pond isolated from ocean by a sand spit across a bay. Seaward side with salt-water plants, inland side with fresh-water plants.
 - A. Yes – Coastal salt pond
 - B. No – Go to 2
2. Permanently flooded flat in tidal creek, salt marsh, or river mouth. Salt-water plants, such as eelgrass, widgeon-grass, and sea weeds *may* be present.
 - A. Yes – Saline/Brackish Flat
 - B. No – Go to 3
3. Permanently flooded flat in upper reach of estuary or tidal creek. Fresh-water plants, such as water celery and naiads *may* be present.
 - A. Yes – Fresh/Brackish Flat

	<p>Separation of these communities is difficult.</p> <p>The main difference is salinity, which may be difficult to identify in the field.</p> <p>Because of this you should use location as an index of salinity.</p>
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Descriptions of Estuarine Subtidal Communities

Saline/Brackish Flats

S4

Description/Concept	Estuarine areas not exposed between tides, generally without emergent vegetation. Species present depends on salinity, water temperature and depth, and substrate type. Areas <2 m deep sometimes support submerged or floating plants. Salinity of water changes with tides and flow of rivers or streams. More protected than marine subtidal communities.
Topography	Includes beds of tidal creeks draining salt marshes and river mouths.
Soils/Substrate	
Canopy	
Sub-canopy	
Shrub layer	
Herb layer	Eelgrass and widgeon-grass may form dense beds. Waterweed, coontail, sago pondweed, and horned pondweed may be mixed in or form locally dense beds. Seaweed can be locally dense.
Leaf litter	

Fresh/Brackish Flats

S2

Description/Concept	Permanently flooded freshwater to brackish water areas subject to tidal fluctuations. Aquatic beds form where water is <2 m at low tide. Shores lined by Freshwater or Brackish Tidal Marshes.
Topography	Permanently flooded upper reaches of estuaries, including upper reaches of tidal creeks.
Soils/Substrate	
Canopy	
Sub-canopy	
Shrub layer	
Herb layer	Characteristic species include: sago pondweed, horned pondweed, wild celery, and naiads.
Leaf litter	

Coastal Salt Pond**S2**

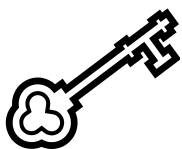
Description/Concept	Vegetation in and surrounding coastal saline to brackish ponds with shallow water. Inland end tends to be fresher, with denser, taller vegetation. Found on the south and east sides of Cape Cod, and along Buzzard's Bay. Water levels fluctuate in closed salt ponds. Shorelines support marsh areas similar to brackish salt marshes.
Topography	Isolated from the ocean (more or less) by sand spits that cut off a bay. Spits may become broken by storms or human intervention, and may reclose by drifting sand.
Soils/Substrate	Mud and sand (in part.)
Canopy	
Sub-canopy	
Shrub layer	
Herb layer	Eelgrass beds often dominate sub-tidal areas of community. Mud or sand shores support mud flat species such as: mudwort, dwarf spike-rush, seaside flatsedge, seaside crowfoot, false pimpernel, waterwort, and shore pygmy-weed. Inland ends (i.e., less brackish end) is similar to landward, brackish, portions of other salt marshes, with beds of narrow-leaved cat-tail, common reed, freshwater cord-grass, saltmarsh switchgrass, bulrushes, and mock bishop's-weed.
Leaf litter	

Plants Associated With Estuarine Subtidal Communities

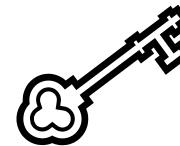
	Saline/ Brackish Flats	Fresh/ Brackish Flats	Coastal Salt Pond
Bishop's-weed, Mock			Occurs
Bulrush			Occurs
Cat-tail, Narrow-leaved			Occurs
Celery, Wild		Characteristic	
Coontail	Occurs		
Cord-grass, Freshwater			Occurs
Crowfoot, Seaside			Occurs
Eelgrass	Occurs		Occurs
Flatsedge, Seaside			Occurs
Mudwort			Occurs
Naiad		Characteristic	
Pimpernel, False			Occurs
Pondweed, Horned	Occurs	Characteristic	
Pondweed, Sago	Occurs	Characteristic	
Pygmy-weed, Shore			Occurs
Reed, Common			Occurs
"Seaweed"	Occurs		
Spike-rush, Dwarf			Occurs
Switchgrass, Saltmarsh			Occurs
Waterweed	Occurs		
Waterwort			Occurs
Widgeon-grass	Occurs		

NOTE: This is not an exhaustive list of plant species that occur in these communities. Rather, it is a list of species associated with these communities as identified in Swain and Kearsley (2001.)

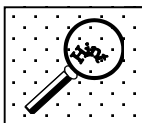
ESTUARINE INTERTIDAL COMMUNITIES



Shortcut Key: Check full descriptions following use of key



- | | |
|--|--|
| 1. Community of exposed soils/sediments (i.e., <u>flats</u>), with rosette-leaved aquatic plants, possibly eelgrass. | A. Yes – Go to 2
B. No – Go to 4 |
| 2. Community characterized by saline species, such as eelgrass, algae, saltpond spike rush, and Atlantic mudwort. | A. Yes – Saline/Brackish Flats
B. No – Go to 3 |
| 3. Community characterized by fresh/brackish water plants, such as false pimpernel, beggar-ticks, threesquare bulrush, and/or wild rice. | A. Yes – Fresh/Brackish Flats |
| 4. Community is an open <u>shrubland</u> along a coastal river. | A. Yes – Fresh/Brackish Tidal Shrubland
B. No – Go to 5 |
| 5. Community is a low stature <u>forested wetland</u> along a coastal river. | A. Yes – Fresh/Brackish Tidal Swamp
B. No – Go to 6 |
| 6. Community consists of herbaceous vegetation surrounding a coastal salt pond. | A. Yes – Coastal Salt Pond Marsh
B. No – Go to 7 |
| 7. Herbaceous community dominated by freshwater species such as bluejoint, jewelweed, climbing hempweed, wild rice, tear thumb, and smartweed. Buttonbush and silky dogwood occasionally present. Narrow-leaved cat-tail also dominant (but may characterize other communities as well.) | A. Yes – Freshwater Tidal Marsh
B. No – Go to 8 |
| 8. Herbaceous community with high marsh dominated by salt-marsh hay. | A. Yes – Salt Marsh
B. No – Go to 9 |
| 9. Herbaceous community with freshwater cord-grass and saltmarsh bulrush along banks, narrow-leaved cat-tail dominant in back marsh. | A. Yes – Brackish Tidal Marsh |



Many of these communities are separated on the basis of salinity, which makes identification challenging in the field.

Descriptions of Estuarine Intertidal Communities

Saline/Brackish Flats

S3

Description/Concept	Non-organic substrates exposed between tides. Sparsely vegetated. Exposed between high tides, covered with brackish or salt water at high tide.
Topography	
Soils/Substrate	Non-organic.
Canopy	
Sub-canopy	
Shrub layer	
Herb layer	Patches of predominately rosette-leaved aquatics, such as riverbank quillwort, river arrowhead, saltpond spike-rush, and Atlantic mudwort. Patches of eelgrass and algae. Plants completely submerged at high tide and usually coated with mud.
Leaf litter	

Fresh/Brackish Flats

S2

Description/Concept	Exposed intertidal flats where plants are completely submerged under about 1 m of freshwater at high tide. Sparsely vegetated. Natural variability in the composition and distribution of the plant associations.
Topography	
Soils/Substrate	
Canopy	
Sub-canopy	
Shrub layer	
Herb layer	Plants are predominately low growing rosette-leaved aquatics, with the lowest leaves characteristically coated with mud. Characteristic species include: false pimpernel, arrowheads, beggar-ticks, threesquare bulrush, and wild rice.
Leaf litter	

Coastal Salt Pond Marsh

S2

Description/Concept	Vegetation surrounding Coastal Salt Ponds. Inland end is fresher, with denser, taller vegetation. Sea-level Fens (see Palustrine flow chart) occur within this community.
Topography	Inland end of shores and salt ponds.
Soils/Substrate	
Canopy	
Sub-canopy	
Shrub layer	
Herb layer	Beds of narrow-leaved cat-tail, common reed, freshwater cord-grass, coastal switchgrass, bulrushes, and mock bishop's-weed grow at the inland ends of the salt ponds.
Leaf litter	

Salt Marsh

S3

Description/Concept	A graminoid dominated, tidally flooded coastal community with several zones. Zones include low marsh, high marsh, salt shrub, and salt panne. Form in areas subject to tides, but sheltered from wave energy.
Topography	Usually occur in estuaries and behind barrier beaches and spits.
Soils/Substrate	
Canopy	
Sub-canopy	
Shrub layer	
Herb layer	Low marsh (between low and mean high tide) dominated by saltmarsh cord-grass. High marsh (between mean high tide and spring high tide) dominated by salt-marsh hay. Spike grass usually also occurs in high marsh. Black grass becomes more common toward upland edge of marsh. Mixed throughout (especially the upper edges) are sea-lavender, seaside goldenrod, and salt tolerant species. Groundsel tree and salt marsh elder may form shrubby zones along upper edges and on ditch spoils. Glasswort and saltwort form in salt pannes in low, poorly drained, salty areas.
Leaf litter	Peat develops in the higher marshes.

[Decision Rules: A salt marsh category (SM) is recognized, but not described.]

Brackish Tidal Marsh

S1

Description/Concept	Mixed herbaceous marsh flooded daily by tides. Community may be structurally diverse, including high and low marsh, and mud flats. Tidal amplitude 0-150 cm (comparable to Freshwater Tidal Marshes.) Average annual salinity 5-18 ppt.
Topography	Brackish reach of (free flowing) coastal rivers. May also occur in smaller patches of upper zones of Coastal Salt Marshes and Salt Ponds, usually near seepages or freshwater transition areas. Occasional occurrences along rocky shores, seepages, and ditches.
Soils/Substrate	
Canopy	
Sub-canopy	
Shrub layer	
Herb layer	Narrow-leaved cat-tail is typically dominant in backmarsh, with frequent stands of common reed. Along the banks, freshwater cord-grass and saltmarsh bulrush occur; associated with saltmarsh sedge and saltmarsh bentgrass. Low marsh supports stands of saltmarsh cord-grass and threesquare. Mudflats and shores support sparse, low herbs such as water pimpernel, mud lily, and creeping spearwort. Plants of freshwater tidal marshes occasionally occur in the higher zones.
Leaf litter	

Freshwater Tidal Marsh

S1

Description/Concept	Mixed herbaceous marsh flooded daily by tides , and occurring in the freshwater reach of coastal rivers. Community may be structurally diverse, including high marsh, low marsh, mud flats, rocky shore, ditches, and drainages. Tidal amplitude 0-150 cm (comparable to Brackish Tidal Marshes.) Average annual salinity <0.5 ppt. This community occurs upstream of brackish tidal marshes.
Topography	Freshwater reach of (free-flowing) coastal rivers.
Soils/Substrate	
Canopy	
Sub-canopy	
Shrub layer	Buttonbush and silky dogwood occasionally present.
Herb layer	Dominant species include: blue joint, sedges, narrow-leaved cat-tail, wild rice, smartweed, tearthumb, jewelweed, climbing hempweed, and sweet flag.
Leaf litter	

Fresh/Brackish Tidal Shrubland

S1

Description/Concept	Dense to open shrubland flooded by daily tides , occurring along freshwater to brackish reach of coastal rivers. There is a great deal of micro-relief (tussocks and hollows) leading to high species diversity. Tidal fresh, or slightly brackish shrubland. Annual average salinity of <0.5 ppt.
Topography	Located in transition between freshwater tidal marshes and freshwater tidal swamps. Patches may also be throughout freshwater tidal marshes.
Soils/Substrate	Usually mineral without significant peat deposits.
Canopy	
Sub-canopy	
Shrub layer	Dominated by sweet gale and smooth alder, with some speckled alder. Some examples have mixture of shrubs such as silky dogwood, swamp-rose, winterberry, common elderberry, willow, buttonbush, and poison ivy. More northern examples may contain arrow-wood and meadowsweet.
Herb layer	Herbaceous associates include royal fern, marsh fern, bedstraws, broad-leaved cat-tail, arrow-arum, New York aster, false nettle, touch-me-not, and swamp milkweed. Tussock sedge may be present in northern examples.
Leaf litter	

Fresh/Brackish Tidal Swamp**S1**

Description/Concept	Low stature forested wetland located along coastal rivers. At upper limit of tidal influence, and flooded daily by tides. This community represents an ecotone from tidal marsh to more typical non-tidal forested wetlands. Tidal amplitude may range from 0 - 40 cm (0 - 16 inches.) Average annual salinity from 0.5 ppt in freshwater areas, with gradients to 5 ppt.
Topography	Along free-flowing coastal rivers. A variation of this community occurs along smaller streams at the upper limit of tidal influence.
Soils/Substrate	
Canopy	Open forest canopy. Swamp white oak and red maple occur on elevated hummocks. A similar association is dominated by more dense stands of Atlantic white cedar.
Sub-canopy	
Shrub layer	Often dense. Typically includes arrow-wood, winterberry, and silky dogwood.
Herb layer	Unusually rich herbaceous layer. Large mucky hollows flooded by daily tides support a diverse assemblage of herbs and graminoids. Herbs and grasses typical of nearby freshwater marsh habitat, including jewelweed, sensitive fern, and wild rice.
Leaf litter	

Plants Associated With Estuarine Intertidal Communities

	Saline/ Brackish Flats	Fresh/ Brackish Flats	Coastal Salt Pond Marsh	Salt Marsh	Brackish Tidal Marsh	Freshwater Tidal Marsh	Fresh/ Brackish Tidal Shrubland	Fresh/ Brackish Tidal Swamp
Alder, Smooth							Dominant	
Alder, Speckled							Occurs	
Algae	Occurs							
Arrow-arum							Occurs	
Arrowhead, Grass-leaf		Characteristic						
Arrowhead, River	Occurs	Characteristic						
Arrowhead, Sessile-fruited		Characteristic						
Arrow-wood, Northern							Occurs	Typical
Aster, New York							Occurs	
Bedstraw							Occurs	
Beggar-tick		Characteristic						
Bentgrass, Saltmarsh					Occurs			
Bishop's-weed, Mock			Occurs					
Bluejoint						Dominant		
Bulrush			Occurs					
Bulrush, Saltmarsh					Occurs			
Bulrush, Threesquare		Characteristic	Occurs		Occurs			
Buttonbush						Occasional	Occurs	
Cat-tail, Broad-leaved							Occurs	
Cat-tail, Narrow-leaved			Occurs		Dominant	Dominant		
Cord-grass, Freshwater			Occurs		Occurs			
Cord-grass, Saltmarsh				Dominant	Occurs			
Dogwood, Silky						Occasional	Occurs	Typical
Eelgrass	Occurs							
Elder, Salt Marsh				Occurs				
Elderberry, Common							Occurs	
Fern, Marsh							Occurs	
Fern, Royal							Occurs	
Fern, Sensitive								Occurs
Gale, Sweet							Dominant	
Glasswort				Occurs				
Goldenrod, Seaside				Occurs				
Grass, Black				Occurs				
Grass, Spike				Occurs				
Groundsel Tree				Occurs				
Hay, Salt Marsh				Dominant				
Hempweed, Climbing						Dominant		
Jewelweed						Dominant		Occurs
Lily, Mud					Occurs			

Plants Associated With Estuarine Intertidal Communities (continued)

	Saline Brackish Flats	Fresh Brackish Flats	Coastal Salt Pond Marsh	Salt Marsh	Brackish Tidal Marsh	Freshwater Tidal Marsh	Fresh Brackish Tidal Shrubland	Fresh Brackish Tidal Swamp
Maple, Red								Occurs
Meadowsweet							Occurs	
Milkweed, Swamp							Occurs	
Mudwort, Atlantic	Occurs							
Nettle, False							Occurs	
Oak, Swamp White								Occurs
Pimpernel, False		Characteristic						
Pimpernel, Water					Occurs			
Poison Ivy							Occurs	
Quillwort, Riverbank	Occurs							
Reed, Common			Occurs		Occurs			
Rice, Wild		Characteristic				Dominant		Occurs
Rose, Swamp							Occurs	
Saltwort				Occurs				
Sea-lavender				Occurs				
Sedge						Dominant		
Sedge, Saltmarsh					Occurs			
Sedge, Tussock							Occurs	
Smartweed						Dominant		
Spearwort, Creeping					Occurs			
Spike-rush, Saltpond	Occurs							
Sweet Flag						Dominant		
Switchgrass, Coastal			Occurs					
Tearthumb						Dominant		
Touch-me-not							Occurs	
Willow							Occurs	
Winterberry							Occurs	Typical

NOTE: This is not an exhaustive list of plant species that occur in these communities. Rather, it is a list of species associated with these communities as identified in Swain and Kearsley (2001.)